US ARMY CORPS OF ENGINEERS

Moderator: Courtney Chambers
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Sarah Miller: And so now a few words about our speaker today. We've got Dr. Craig Fischenich with us. He's a Senior PI Research Civil Engineer and Ecosystem Restoration Technical Lead for the ERDC EL here in Vicksburg, Mississippi.

Dr. Fischenich leads teams of engineers and scientists in the development of criteria, tools, and methodologies for aquatic ecosystem restoration management. He's published over 300 journal articles, reports, and conference papers on ecosystem restoration and related topics. Dr. Fischenich has served 21 years in his current position preceded by seven years in the Omaha District Corpss of Engineers as the Chief of Special Studies Unit and two years with the South Dakota Department of Game Fish and Parks. Over his career he's worked in all 50 states and several countries. And his projects have garnered considerable national and international recognition and award. Dr. Fischenich earned his BS and MS in Civil and Environmental Engineering respectively at South Dakota School of Mines and Technology and was awarded a PhD in Environmental Hydraulics at Colorado State University. With specific relevance to our discussion today Dr. Fischenich was a contributing author to the Corpss' implementation guidance for adaptive management. He's written several papers and reports on planning and implementing adaptive management plans and programs. Has helped develop adaptive management plans for Louisiana Coastal area and is currently assisting the Missouri River Recovery Program in developing and implementing their comprehensive adaptive management plan. I believe he will be discussing additional details on one or both of these programs in his presentation today.

So again welcome everyone to today's program and here is Dr. Craig Fischenich.

Dr. Craig Fischenich: Thank you Sarah. I'm going to go ahead and switch over to my desktop. That was a very nice introduction a lot more than I expected it. It's mainly I guess a reminder of how old I've gotten and how long I've been working on some of these efforts. I've had some involvement with adaptive management off and on now for oh about the last 20 or 25 years.

A lot of that activity has picked up quite a bit since WRDA 2007 partly because of changes for the Corps of Engineers in terms of approach to monitoring and adaptive management and partly circumstantially because of some major ecosystem restoration efforts that the Corps is involved with and that I've had some good fortune to be able to get involved with myself.

I appreciate the opportunity to talk to you today. My objectives are fourfold summarized on this slide. I'd like to introduce to you and have some discussion about my perspectives regarding different types of adaptive management different approaches or strategies related to adaptive management and how they may fit in to different efforts that you all may be undertaking in the Corps. I'm going to take some time to describe methods and approaches that have been taken for developing and implementing adaptive management plans in the Corps and elsewhere. And pass along a few lessons learned from those efforts. And finally and perhaps most importantly try to establish a foundation for the following five Webinars that will be a part of this series over the next month and a half or so.

You can feel free to ask questions as the presentation goes along. If you would first I guess if your phones not muted you might want to double check that I know somebody's typing right now.

If you do have questions or need clarification during the presentation you can either raise your hand or use the chat feature and we'll pick up on those questions and try to get those addressed. Other questions if it's not just a matter of clarification that's necessary at the point it might be more helpful to hold those till the end so we can engage in a little bit more discussion.

So Courtney my computer seems to be - it's not wanting to advance the slide. I don't obviously I still control?

Courtney Chambers: You do. And we're - yes we- re still on the participant - or I mean on the purpose slide at the moment.

Dr. Craig Fischenich: Yes, yes.

Courtney Chambers: It's not going for you?

Dr. Craig Fischenich: It is locked up for some reason.

Courtney Chambers: Can you exit out of PowerPoint and...

Dr. Craig Fischenich: Yes. Trying right now. This is our worst nightmare right? Let me see...

(Igor): Sorry (Igor) just joined.

Dr. Craig Fischenich: Thanks (Igor). Let's see here it seems to be just the PowerPoint that's the problem. Let me try to cancel that out actually that may have been enough there yes. Okay.

So I'm not going to begin the presentation with an obligatory definition of adaptive management. I think most of you have a pretty good sense what adaptive management is and what it means. But I have included a definition at the end because I'm hopeful that after this presentation your opinion about what adaptive management is might have changed a little bit and so there are a couple of elements of that a definition at the end that are relevant and may be important.

I'll be using some other terminology here that's listed on this page. Most of it's probably familiar objectives and hypotheses I think folks understand.

I'll be talking about performance measures which is a term that we use quite a bit in adaptive management to refer to the metrics that are being monitored and evaluated.

I'll also refer to decision criteria and I may call those targets in some cases. Those will be numeric values or conditions related to the performance measures that either indicate success or initiate or trigger some decision that might be necessary.

And then you'll see the term contingency action or contingency plans. And those refer to the adaptive actions that we take once we learn that we need to make some modifications.

So adaptive management's been around for a long time, you know, certainly on the order of thousands of years. There is evidence of former cultures employing adaptive management which, you know, in it's, you know, barest form is in essence learning while you're doing and then making adjustments on the basis of what you've learned.

Now a couple of folks in particular CS Holling and Walters who both happened to be University of British Columbia in the 70s and 80s are probably credited with most of the, you know, conventional theory and concept related to adaptive management as it's applied to natural resource management. And they've expressed certain viewpoints on how adaptive management can proceed. And I'm going to build from that here and just a moment and talk a little bit about their perspectives. And I'm going to add in a new way of looking at adaptive management that I think's been emerging here certainly in the Corps and perhaps with some other agencies of late.

So this diagram sort of expresses the kind what I'll refer to as a traditional view of adaptive management wherein you develop a plan, you design and implement a plan, and then you monitor and assess the performance. And based on that assessment you decide whether to continue to operate the way you have been, whether or not you've been successful, or potentially whether you need to reformulate, or adjust, or modify the plans or operations. And this diagram of course suggests of an iterative process. And for the most part that's how adaptive management has been viewed and has progressed over the years.

Most of that adaptive management that's occurred in the past can be -- shut that down -- can be viewed I think in the context of what we call passive adaptive management. This is where, you know, we as I just described use monitoring to learn about performance of a project and update our knowledge and understanding. And then based on that we may or may not make some changes in our policies, or operations, or other characteristics associated with a project. The passive adaptive management, you know, oftentimes proceeds without a very or particularly structured monitoring or decision plan. In fact oftentimes it really doesn't have any kind of governance or decision process

explicitly stated for its implementation. And because of that passive adaptive management oftentimes is not very successful.

I'm having these problems again. Let me try it over here. There we go.

So some examples of passive adaptive management in the Corps although these have changed to some extent, but Upper Mississippi River and Columbia River Channel Improvement Project both were implemented initially with what I would regard as passive adaptive management strategies.

Again as I mentioned those have evolved a bit for both of those programs and in ways we'll see in just a minute.

So one of Holling's big contributions to adaptive management principles and philosophy was this notion that as opposed to a passive strategy for adaptive management we ought to consider what he regarded or termed active adaptive management which is a hypotheses driven approach where we use a project to deliberately experiment and learn from so that we can improve our implementation of later projects.

In other words to give you an example let's say we had a program that included coastal restoration. And we were going to be restoring barrier islands as part of this. And, you know, we think that the right height to construct a barrier island is say four feet above sea level but there is some uncertainty related to that. So we may structure an early project to include barrier islands or parts of barrier islands that are built to four feet, eight feet, two feet; several different elevations. And we'll monitor the performance and see which one happens to provide the best performance or the greatest output. And then use that knowledge for future implementation.

Now that approach requires some tradeoffs because, you know, upfront your, you know, your deliberately structuring your projects to be suboptimal or at least to the extent that you understand how the system behaves. And so you may not derive in early stages as significant a benefit but the point is that the knowledge gained from doing that will increase those benefits over time. This is a very structured science kind of research oriented type approach. And designing these experiments in a way that allows you to learn appropriately from them and control outside influences and so on can be a real challenge.

Now there are several examples of this in the Corps programs and elsewhere. I think, you know, one of the better examples out there is the Platte River which is almost entirely a hypothesis driven adaptive management program where they have what they referred to as their big questions. And those big questions then dictate most of their decisions about project implementation.

So these two concepts of passive and active adaptive management aren't particularly new again. They date back to the 70s. And we've seen many examples of both. What we've seen I think in the last half dozen years or so is an emergence of what I'll referred to as an objective based adaptive management strategy. And I think this particular approach lends itself very nicely to a lot of the ecosystem restoration and mitigation work that the Corps of Engineers gets involved with.

At its core, what it boils down to, it is a structured approach to adaptive management where we're focusing on the objectives. And what we're monitoring is performance relative to those objectives to ensure that we are seeing the types of outcomes that we're projecting or had hoped for. And then evaluating performance relative to those objectives and making decisions about whether or not to adjust those projects or those programs.

So this approach requires that you give very close consideration to outcomes from your projects. You have to be able to forecast or predict the outcomes that are expected. And then be in a position to identify what I called earlier performance criteria that would determine whether or not and when it's necessary to step in and make some adjustments. And this strategy then oftentimes also employs these pre-defined planning contingencies which are the actions that are likely to be taken.

So some examples of this objective based adaptive management would be the Louisiana Coastal Area Program and the Missouri River Recovery Program. All of the latter like CIRP and many others really has all three of these elements involved in the overall program.

So there are components that are objective based where that makes sense. There are components where we are engaging in hypothesis testing in the form of active adaptive management. And just because we're monitoring these systems and monitoring response inevitably you're going to learn in the same sort of fashion that you would through passive adaptive management strategies.

So considering these three different approaches most of my presentation today is going to focus on this third. How do you develop an objective based adaptive management plan or program for a project or a group of projects? And what are some of the lessons that have been learned in doing so in various projects that we've had some engagement in?

I'll mention that there are common elements to all three of these approaches. All three involve embracing risk and uncertainty. And that's a, you know, a fundamental tenet of adaptive management is it allows us to move forward even though we have uncertainty about the outcomes and there may be risks

related to that uncertainty. All of these approaches require explicit characterization of that uncertainty and generally through the use of conceptual and numerical models. They all involve iterative decision making where we implement, monitor, learn and adjust. And so there is that feedback process and engaged with the learning. And to be successful all of them have to have a functional governance and decision process where decision makers are willing to and able to make some change based on what's been learned.

Now I'm not going to spend a lot of time talking about policy related issues. It - we have policies related to adaptive management. As is always the case these evolve over time. And I would just encourage you to check with, you know, whatever the current policies are related to on the activities that you're engage with.

But so I'll mention briefly that, you know, there was a bit of a sea change here in the Corps when WRDA 2007 was passed. There were two sections in there that dealt with issues related to monitoring and adaptive management. And the implementation guidance for planning that came out subsequent to that is shown here. And I summarized a few of the key points.

The bottom line is that for ecosystem restoration feasibility studies we're now required to prepare a monitoring plan, the focus of that plan is on when and how we determine success and the implications of that with regards to continued monitoring and cost sharing activities. But it also addresses the use of contingency plans. And the implementation guidance requires that we consider adaptive management plans for any ecosystem restoration project. And that we include within the project documentation a rationale for the monitoring and adaptive management if it's included.

If we identify any performance standards and metrics for success. We've got to describe the nature of the contingency plans or measures that might be taken. We need to identify the duration which by the way in terms of at least federal funding does not exceed ten years. We have to address the cost of monitoring an adaptive management. And whom the responsible parties are? How decisions are made and so on?

These plans are usually reviewed during the ATR process. But depending on the scope and scale of the effort and in fact the guidance does address the need to scale the monitoring adaptive management to the scale of the project. And that can sometimes be a bit of a challenge. I think there may be a perception that cost or maybe even geographic scope is a reasonable scale or I'm going to argue that oftentimes very large ecosystem restoration projects have very little uncertainty associated with them. And so the need for adaptive management's minimal. And you can have very, you know, relatively small inexpensive projects that have a lot of uncertainty and opportunities for or needs for adaptive management may be much greater in those cases. But the point of giving consideration to those is certainly important.

So - and this notion of determining success is a critical one as well because again the guidance from WRDA 07 limits federal funding for monitoring activities and presumably associated adaptive management to ten years. Of course any individual project or program could have authorizing language that stipulates or specifies how adaptive management should be handled it may differ from that. So you'll, you know, need to follow whatever the appropriate guidance is.

One point that I'd like to make is that, you know, although we, you know, most of us probably on this call have backgrounds in natural resource conservation or ecosystem restoration. And we've got that motivation and

probably think of adaptive management as a sort of god, motherhood, apple pies sort of thing. And the truth of the matter is that adaptive management is not always appropriate. And there are circumstances when it does not make sense to adaptively manage a project.

This slide lists some conditions or characteristics under which adaptive management should be considered. I - and you can read through these and get a general idea.

A group of folks within the Corps were engaged recently last couple of years in developing a technical guide for adaptive management in the Corps. And this is a figure that I extracted from that effort. Actually we developed this initially for Louisiana Coastal Area Program.

It was a way of structuring this question should we be, you know, is adaptive management needed in this particular case? And so there are a couple of elements that I think are critical for adaptive management to be useful.

First of all you have to have some uncertainty in the outcome. If we - if we're highly confident of the outcome there's not much uncertainty there's little point in adaptive management.

Also we need to have an adaptive action that could be taken and likely would be implemented. And in other words even if the projects going off course not the way we had intended for it to go unless there's something we can do about that to get it back on track you really don't have an opportunity for adaptive management.

I guess you could argue that monitoring leads to learning, learning leads to improvements in decision making down the road on other projects and that

that sort of a form of passive adaptive management. But I'm referring to a more structured approach here where there are certain elements that need to be available.

So this little schematic is set up to say, you know, to guide us through that decision. It begins with is there something we could or would do about it if it wasn't performing as expected? And if the answer to that's no then you're not going to adaptively manage it. If it's yes then these remaining questions deal with the issue of uncertainty and ability to implement decisions.

Another consideration for whether or not adaptive management is appropriate is whether or not we're likely to see a reasonable return on that investment. Adaptive management isn't free. There's cost associated with the monitoring. And there's costs associated with the adaptive action that you're going to take. And in many cases those costs will need to be shared with a project sponsor or a stakeholder. And so we need to think about whether or not those added costs will be offset by the gains that we would achieve through implementing some adaptive action.

Just a heads up we've been developing a tool to help answer that question quantitatively. I expect we'll be having a Webinar rolling that tool out initially in the next month or two. And then based on feedback from that and some testing on a couple of different efforts that we've got underway hopefully we'll have that tool available by the end of the calendar year. So keep in touch if that something that you are interested on or interested in.

Shifting gears a little bit I thought I'd talk to you a little about how we go about developing adaptive management plans and some of the different strategies that you can employ and some of the things that we've done on different projects.

So here I've outlined I guess an eight step process for developing a plan, you know, these steps aren't set in stone and can be adjusted as necessary. But on many of the projects we've been involved with its unfolded more or less along these lines where we start by identifying an adaptive management team. Now if is just a - you know, a reasonable sized project that adaptive management teams usually just a subset of the PDT that's involved. In other cases like on LCA the folks in New Orleans set up a panel, a group of people from outside for the most part outside the organization to come in and provide assistance on - to the PDTs on developing their adaptive management plans. But the bottom line is there needs to be a responsible entity for putting these things together. And essentially the process is to develop good objective statements and associated with those one or more metrics preferably direct measures but indicators when that's not possible, identifying performance standards associated with each of those metrics, and success criteria. Giving consideration to any critical constraints the term risk endpoint here refers to a constraint or an objectionable outcome something we want to avoid. Identifying contingency plans that could be implemented than if any of the decision criteria are triggered.

And then you need to establish a baseline condition that's used for the purpose of monitoring so that you can assess progress towards your goals.

You need to identify and sometimes develop any models or tools for forecasting and then evaluating progress.

Depending on the complexity of the project you might have to come up with some kind of a data management plan.

Importantly and I'll make this point several times because it really is critical one you need to establish a governance and decision structure. And that needs to be established up front who needs to make decisions about whether or not to implement adaptive actions and how that process unfolds.

And then finally there is this issue of cost estimating which can be one of the trickiest aspects of the overall effort.

So what I've seen evolving and probably made some contribution to in some ways is a what I consider a two phased approach to this objective based management adaptive management planning effort. And what the first part of it is the planning phase. That's where you develop the plan and you consider the consequences that adaptive management in terms of overall project performance and alternative formulation.

And then there's an implementation phase that kicks in post project construction and begins with monitoring, and assessment, and carries on through the overall decision making process and several other things can happen along the way.

I'm going to talk in a little bit more detail about each of those now. The planning phase really is two pronged in a sense. The slide that I showed previously here that has the planning and implementation approach, both of those actually are described in the adaptive management plan. But the planning phase itself really mainly engages or involves the first four primary bullets here. The remaining five although they're described in the plan they take place after project implementation.

So, you know, it's establishing goals and objectives. You know, undertaking this assessment that I described a little bit ago related to each of those

objectives, and associated uncertainties, and different outcomes, and planning contingencies that you might take and establishing the decision criteria that are associated with those.

And again as part of that plan we're going to then also describe how we're going to monitor what the monitoring protocols are, how we're going to make assessments, who's going to make decisions, what types of contingency actions might be implemented, when, how we're going to report and communicate progress and so on. So all of that's included in the plan.

But one of the ways we've elicited information from PDPs in order to help develop that plan is by posing to them a series of questions. And some of the more common questions that we ask are listed here.

So if I were to sit down with a PDP that was working towards developing an adaptive management plan the first question I mean, you know, once I've got a little bit of background about the project I'd ask them to very clearly indicate what the project objectives are.

And then I would ask them what, you know, the expected outcomes of their project are how do they anticipate this unfolding?

Another good question to pose is when would you consider the project to have been a success? What criteria could you identify that you would say okay job done we can move on?

And then we move on and do a discussion of metrics, indicators, or other measures to help track progress towards the objectives.

I want to learn a little bit more about any key constraints that relate that might help establish those risk end points that I referred to earlier which by the way will typically have associated with them some type of a contingency plan as well.

And then we would start talking about issues of uncertainty. And, you know, where are the most critical sources of uncertainty are and different mechanisms that might be available to address those.

An important part of this that part that I think in a lot of ways is transformative in terms of the way we plan projects is to ask hard questions about alternative outcomes.

You know what - are their consequences associated with our action that, you know, we could reasonably anticipate, you know, if we had five years of drought what would happen? If we had a major Flood what would happen? If you lost funding in the third year what would happen? All of those suggest different scenarios that might lead to the development or establishment of some sort of adaptive action that could be put into place such that we would ensure that the outcomes, you know, match our expectations in most cases. And so a lot of, you know, it's a lot of this what if type questioning that we need to probe and get an idea of, you know, the various outcomes that could occur. And with that information then it becomes a lot easier to systematically work your way through these linkages between objectives, and constraints, and the monitoring an adaptive management plan.

So the bridge between those are the success criteria, other performance measures, and then any of these action criteria that would stipulate that we might take some sort of an adaptive action.

And in following Web casts as part of this series we'll have folks who are going to spend a fair amount of time talking about how to develop good objective statements, How do identify and employee good metrics, and how those things fit together.

So I'm not going to spend a lot of time on that. But just for the, you know, for the point of this presentation to make sure everybody understands when I'm talking about these things, you know, I might have a performance measure for example related to wetland hydrology. And for a particular application that, you know, the specific metric might be the number of days a year that a wetland is inundated. And then my decision criteria or action criteria would have some specific quantification related or quantified value related to that metric that suggests that an action would be taken. In this example, you know, if inundation is greater than 30 days during the months of July through September we're going to do something. And then we would go on to specify what it is we would likely do.

And you can see from the other examples here what, you know, the general notion. So this is the idea then that we would go through this in a very systematic way for every objective.

And so here's an example this one also happens to be taken from LCA Convent/Blind River Diversion. And so one of the objectives was listed as we'd like to establish a hydro period with dry periods of sufficient length to improve bald cypress and tupelo productivity, seed germination and survival.

So the problem was it was too wet. It needed to have, during a particular time a year, enough drawdown that we could get bald cypress and tupelo established. So there were two performance measures that were identified related to that objective. The first one was depth, duration, and frequency of

flooding. The other one was the number of bald cypress and tupelo seedlings and saplings that established. So for each of those we described what our targeted outcome was. And this could be regarded as a success criteria.

So for the first one we wanted to maintain dry period but with moist soils in the swamp for a minimum of seven to 35 days during the summer and early fall to allow for seed germination. And then we need to maintain water levels below the seedling height long enough that they'd survive.

The way we're going to monitor that is we're going to put hydrologic recorders in the area to monitor stage or depth on an hourly basis during that period that we're interested in. And there was a trigger established. And that's when the depth of inundation fails to drop below those targeted levels for less than seven days and in a year or less than ten days in two consecutive years. If that happens we're going to modify the gate operations to reduce inflow to the project area. So this is a situation where there's some control on the hydrology.

For the other one you get same sort of notion all right. We want, you know, we had a performance measure related to the number of seedlings and saplings. Our target was a 25% increase in five years and a 50% increase over ten years. The monitoring involved basically getting in there and measuring the number of seedlings and saplings. The trigger was if we saw no statistically discernible increase in the number of saplings after five years. In this case we didn't specify contingency action. We need to evaluate conditions then and determine why that might be happening.

The idea is we might be meeting the first performance measure. We actually are providing enough dry time but we're still not seeing seedlings and saplings. And so that means maybe there's something else going on here.

Maybe our hypothesis about, you know, not enough dry period wasn't a correct one. So the idea is that with a combination of these different performance measures associated with the objectives we can learn and adapt the project as we go.

Woman: Craig we had a question right quick.

Dr. Craig Fischenich: Okay.

Woman: The question was about contingency actions. Shouldn't they be identified during the planning phase but then determine whether or not they get implemented during the implementation phase?

Dr. Craig Fischenich: Yes that's exactly correct. So to the extent that you can do so -- and this was one of the real the most valuable I think aspects of this type of strategy -- is if you can identify those contingency actions ahead of time as part of the plan formulation process then you can budget for them. It makes decisions a lot easier in terms of implementing. We've already decided and everyone's agreed, the agencies, the stakeholders that if this happens this is what we're going to do about it. You've got NEPA coverage already for those actions then too because you you've consider them ahead of time. So to the extent that you can you want to try to identify as many of those contingency actions and incorporate them into the plan is you can.

And one other point I'll mention is as part of the formulation process when you're evaluating alternatives if you have identified those contingency actions than that has an influence on the benefit stream that you're projecting for a project. So that can influence, if I had two different alternatives that in and other ways were approximately the same but one of them had adaptive management with these contingency actions identified I'm going to have

better at least statistically speaking, I'm going to get better output from the one that has adaptive management. Now there's added cost associated with it too. And that needs to be taken into account. But that's sort of the basis of that tool that I referred to earlier on return on investment.

But in any case yes that's the general idea. And consider them, and identify them, and evaluate them during the planning process. And then in the implementation phase is when you actually exercise the decisions to do that.

Okay I'm going to move - try to speed up just a bit here. Whoops conceptual models play a very important role in guiding adaptive management programs.

This is a conceptual model from the Missouri River Recovery Program that's geared towards implementing reasonable and prudent alternative that was identified in a biological opinion.

In this case for least terns, the program deals with least terns, (piping clovers), and pallid sturgeon. And this conceptual model identifies the drivers and physical response from those drivers that are influencing the ecology of the Missouri River and having an effect on imperial least terns.

This particular model also includes some nice elements to help guide decision making for adaptive management considerations given to the degree of uncertainty associated with some of the relationships here. And remember adaptive management targets uncertainty. And then it also identifies relationships or components of this model that are considered more important than others. And of course those are areas where we want to focus. But it can also set up competing hypotheses. And, you know, these are things that we think could be this way but we've got another model that suggests it might be that way. And where we have those competing hypotheses we have

opportunities for active adaptive management where we can implement projects that are geared towards testing those and developing a better understanding. So this is usually a first step or at least a precursor to developing a good adaptive management plan.

Now I mentioned that conceptual model identified at least qualitatively the primary sources of uncertainty. And again that's kind of a cornerstone of adaptive management. So as we work through these efforts we're interested in understanding the various sources of uncertainty.

Here, and this is a slide I borrowed from (Craig Fleming) on Missouri River and made some adjustments to. But we're interested in uncertainty at the programmatic level. I mean big, big scale questions as well as at the level of individual projects. And the idea is to, you know, try to identify the different scales of uncertainty and where and how they apply because ultimately -- and this is one lesson learned through in a lot of the bigger Corps ecosystem restoration programs -- is there is a clear difference between a project and a program in terms of how an adaptive management plan is structured.

So the example that I showed you earlier with - on the Convent/Blind River was for a project right? So we had these performance measures and criteria that were related to how that particular project was performing.

And often times in ecosystem restoration efforts, that project related focus is on how, you know, how changes to the habitat occur and, you know, what types of physical, chemical, or biological conditions result from that particular project.

The programmatic levels a different one in many regards. For one, in essence a programmatic adaptive management strategy deals with the cumulative effects of a bunch of different projects.

This is an example from MRGO where there are many, many individual projects planned as part of an overall restoration program. Now there - the two are different in a couple of logical ways. First of all they have different objectives right?

So a project the objectives usually are related as I said earlier to, you know, changing habitat conditions or something to that effect. Objectives at the programmatic level are usually much broader, more sweeping, might relate to a - the response of these species, or, you know, regional, or basin wide resilience or something to that effect. So if you follow the strategy that we've outlined you've got different objectives. That means you've got different metrics which means your monitoring different things.

And the suite of actions that you have associated with each differs right? So at a project level I can go in and change operations, I can go in I can increase the, you know, that aerial extent of an island, or I can go in and, you know, dredge a channel.

At the programmatic level I can decide for example well we're not going to do any more barrier island restoration because that's not working we're not getting what we wanted out of it or I'm not seeing the kind of response in pallid sturgeon that we've been anticipating so maybe shallow water habitat which has been the focus is really not what we need to emphasize. And we might need to emphasize other types of measures so different objectives, different uncertainties and sources of uncertainty, and then different suites of adaptive actions demand that they be treated differently.

And a lot of times you'll have both. I mean this is the case for Missouri River, LCA any of these major restoration efforts have adaptive management that's focused at both the project and the programmatic level. If done right they can use the same decision and governance structure but they'll have different components in terms of what it is that we focus on.

And so this slide just sort of summarizes how the programmatic and project viewpoints may differ in terms of objectives, uncertainties, performance measures and the types of management adjustments that you might make so that - just a one thing to keep in mind.

And for the Missouri River Recovery Program this is a slide that just explicitly acknowledges that what we do in terms of programmatic and project related goals and objectives differ. But we have the same assessment project process and decision making process for both. And, you know, stakeholder engagement is the same for both.

So anyway the - this particular slide is another extract from the Corps of Engineers adaptive management technical guide that's in a draft form now. And it's just relating the adaptive management set up phase down here on the lower part of the screen with the Corps's traditional six step planning process to show that there's overlap and synergies between the two.

The output of - that is this adaptive management plan that then goes into the implementation phase. And I'm going to spend a little less time talking about the implementation component of this in part because, you know the planning part of it is so critical and the implementation part of it aside from this again I'll make this point many times about decision making. The implementation

part of it is something that's going to be talked about in a lot more detail in the following Webinars in this series.

So again the implementation builds from these objectives, metrics, and associated decision criteria as part of the implementation as part of the planning process where you're dealing with implementation phase.

You know, the point is you really want to define how that process is going to occur. How the results of monitoring and assessment are going to be used to make decisions and what types of actions might be taken under what circumstances?

It needs to clearly define the process for decision making. Who is going to make decisions? When that's going to occur? How that information is shared with others? What role agencies or stakeholders have in that process if any and so on. So it needs to lay out in detail a lot of important considerations.

Another extract from the technical guide that lays out a kind of a generic process for this that appears complicated and could be made so but it could be simplified in a lot of different ways.

For a large program there might be a lot of different entities involved in this flowchart whereas for an individual project it might be three or four people that handle everything that's shown here. So the process is easily scalable from project to program and scalable across a wide array of program or project complexities.

So the general idea here though is just following through is, you know, after you've monitored and collected information that information needs to be assessed. And you then apply the decision criteria that have been pre-

established. And make a decision as to whether or not you've exceeded any of those criteria. If not one of two things can happen. One is you might have determined that you've been successful and you exit you're done. The district commander prepares a letter. And the division commander determines success. And monitoring ends and we shake hands and move on.

It could be though that, you know, you haven't triggered any of those decision criteria but you haven't met your success criteria either. In that case you're just going to continue on with what you are doing and keep monitoring.

If there has been something triggered you need to have somebody who is involved in evaluating why that might have occurred. And they would make typically make a recommendation as to whether or not to implement some adaptive action. Now it could be something automatic like those contingency plans that we described earlier or it could be something that requires an analysis for assessment.

And built into this particular flowchart are some - is the ability to adapt your decision process or adapt your adaptive management plan because as you learn more you're going to find in some cases that maybe the criteria that you established initially just weren't reasonable and they need to be changed or maybe the monitoring programs not picking up just the right information that you need and you need to make some revisions to that. Monitor for another year two before you can really make an informed decision.

The point is building into this process flexibility and including in this process enough detail that everybody understands who is going to be engaged, and is governing, and decision making process and how that's going to unfold over time.

Courtney Chambers: Craig just a time check. We - I've got about five minutes okay?

Dr. Craig Fischenich: Yes. Yes I'll try to get through the last few of them here pretty quickly so this just another flowchart that shows how decisions might be made under certain circumstances. And this one's a Corps of Engineers specific flowchart.

Again this presentations going to be available for download. And you can pull this down and look at the details of this a bit more.

But this is just a situation where you might encounter cases where you really don't have the authority to make decisions and you might need to have a deficiency correction or something along those lines. And this just outlines one process for accomplishing that.

I'm not going to get into a whole lot of detail about modeling efforts save to note that good adaptive management plans typically have associated with them a strategy for forecasting, quantifying, and evaluating outcomes from our actions.

And so, you know, the development and updating of these numerical models or the various decision models is an important part of adaptive management.

This is an example for a coastal restoration project where, you know, actually a group of models are involved in predicting and forecasting outcomes. And there's is a lot of built in uncertainty.

And so over time as we learn as we adapt we should be able to improve these models. And then these models help us in decision making in the future in terms of program elements that are implemented.

A lot - the next couple of presentations in this series are really going to get into a lot of detail on monitoring so I'm not going to spend much time at all.

But I did just - I did want to point out a couple of things related to that. This particular definition is important in that it uses the words systematic collection and analysis that suggests that it's not just collecting information for information sake.

It's all very specific...

Courtney Chambers: Craig we've lost your PowerPoint it looks like.

Dr. Craig Fischenich: I saw that. Yes. It just said that the meeting ended. Well I only had a couple more slides in any case. So I'll just describe those to you really quickly and you all can again download the presentation.

From a monitoring standpoint I had a couple of key points. One of them is don't underestimate the desire to monitor without any application. And this is a common problem. I see it all the time where monitoring programs are developed that where they're monitoring all kinds of things that really have no relevance to any decision that's ever going to be made. And it it's just not economical it's not effective. So, you know, my recommendation is that you're monitoring program should be very structured very specific. It should relate to those key objectives, the metrics associated with them, and they ought to be clearly usable from a decision making standpoint.

And then one other point related to monitoring is you need to develop some sort of effective mechanism for documenting and communicating the results.

You might want to take a look at - and there are several good Web sites that have information about how some of the existing programs are operating.

Comprehensive Everglades and its part of LCA part of the Louisiana Master Plan approach both have really good systems for documenting and communicating their monitoring results.

They use information that's compiled at several different levels of detail. And particularly useful are these report cards that they developed.

So take a look at the C-R-M-S data site and the (CERP) Web site. And look at how they structured these report cards because they're great ways of communicating.

I had a couple of quick slides on some of the major adaptive management authorities within the Corps Lower Columbia, Missouri, Upper Miss., LCA and Everglades and was going to talk a little bit about those.

But just to skip ahead there among the last couple of slides in the series there is one that relates to whether or not there's a culture change underway. I think there is within the Corps and within federal agencies in general where policymakers, managers, technical experts and stakeholders are increasingly becoming comfortable with adaptive management.

And I've got a little matrix in there that identifies, you know, perceived threats, what's lost with adaptive management, what's gained with adaptive management for each of those groups of folks. And then what's needed for success.

But if you take a look at that, you know, it I think it'll help you understand the different viewpoints of those what other - whichever three groups you don't belong to and it's helpful to understand their points of view.

That culture change that's underway is manifesting itself in several key ways. There's a slide there that I've titled Indicators of Success related to that. And you can take a look at those and get a sense of how things are moving.

My last couple slides relate to the benefits of adaptive management and common reasons for failure. So I'm going to read a couple of these points to you and then we'll stop.

You know, the benefits of adaptive management I think a lot of these are probably self-evident. But, you know, you can anticipate and improve probability of success for a project or a program because of that ability to adapt. It incorporates this, you know, flexibility and robustness into your approach that will improve operations and contribute to that greater likelihood of success.

It allows you to move forward in the face of uncertainty. And that's critical. I mean the alternative is to wait to collect more data and hope that you're going to understand things more and reduce risks further before you move forward. And a lot of times that's just not necessary. And you can move forward with that uncertainty.

Adaptive management in every instance I've been involved with has led to better collaboration and better conflicts resolution with the agency, stakeholders, and even internally within the Corps with different areas of expertise.

And more cost effective moves (unintelligible) signs forward and so on.

And then reasons for failure. Number one, lack of an effective decision making process. That's - there is no question that's the primary reason adaptive management plans fail. They - you monitor and evaluate all you want. But if nobody's going to make a decision to do anything as a result of that it's all pointless.

Other reasons are no internal buy in. You'll, you know, typically scientists, or, you know, biologists, and ecologists will be promoting adaptive management. And others in the organization really aren't that, you know, they haven't bought into it and they haven't been engaged enough to buy in.

Inadequate collaboration with stakeholders, poor objectives, poor metrics, bad monitoring program design, monitoring was never done or the data wasn't analyzed, or the results of the analysis wasn't conclusive usually that's because of bad metrics and monitoring program.

And - or more external factors present or prevent the implementation of decisions. So my kind of overarching lessons I guess then are an adaptive management, at least objective based adaptive management, has a critical planning component associated with it. And it's as I said earlier I think transformative in terms of planning and how we view projects.

Development of an adaptive management plan is as much about the process as it is the product. You know, it's engaging people in that decision making effort and confronting uncertainties and talking through different outcomes for a project is easily as valuable as the adaptive management plan itself is.

Don't forget that adaptive management isn't necessary for all projects. And those criteria that I defined earlier will help you determine whether or not adaptive management is appropriate for a particular project or not. The governance issue is crucial.

One of the biggest challenges that we've had is in cost estimating because of the uncertainties associated with whether or not certain things will be implemented and so on. That can be problematic. That's an area where we're trying to focus some attention.

And then finally refinement of your plan stream PD is likely. And so being flexible is helpful.

So to me adaptive management my definition is that it's a structured purposeful strategy to optimize actions, make informed decisions, and achieve objectives in the face of uncertainty. That's how I would characterize it. And those particular words I think have a lot of meaning and distinguish this objective based approach from the passive adaptive management the kick-the-can-down-the-road kind of approach to it that has been more commonly employed in the past.

My last couple of slides when you if and when you download them have some references and include how you can download this presentation which I guess since you haven't yet downloaded that that might be a challenge maybe Courtney or Sarah can get information out to everybody if you didn't happen to jot it down from the first slide.

So we've got ten minutes or 15 minutes for questions.

END